Memorandum

U.S. Department
of Transportation

**Federal Highway
Administration**

6300 Georgetown Pike
McLean, Virginia 22101

Subject: **ACTION**: LTPP Directive D-61
Translation of LTPP Cracking Data for
National Applications

Date: August 26, 2015

From: Jack Springer
Long Term Pavement Performance Team

Reply to
Attn of: HRDI-30

To: Mr. Gabe Cimini, PM - LTPP North Atlantic Regional Contract
Mr. Gabe Cimini, PM - LTPP North Central Regional Contract
Mr. James Sassin, PM - LTPP Southern Regional Contract
Mr. Kevin Senn, PM - LTPP Western Regional Contract

Attached is Long Term Pavement Performance (LTPP) Program Directive D-61, this is the Translation of LTPP Cracking Data for National Applications.

Please make this directive available to all personnel involved in distress data collection and processing.

If you have any questions concerning this transmittal, please do not hesitate to call me at (202) 493-3144.

Attachment

FHWA:HRDI-30:JSpringer:js:493-3144:08/26/15
File: M:\LTPP Directives\Distress\D-61
cc:
John S. Miller (TSSC)
Jonathon Groeger (TSSC)
Jack Springer
Directive Binder
Official File

LONG TERM PAVEMENT PERFORMANCE PROGRAM DIRECTIVE

For the Technical Direction of the LTPP Program

Program Area:	Monitoring	Directive Number:	D-61
Date:	August 26, 2015	Supersedes:	N/A
Subject:	Translation of LTPP Cracking Data for National Applications		

INTRODUCTION

The objective of this directive is to provide information on and/or instructions for the translation of selected LTPP cracking data to other applications. The specific applications are:

- Federal Highway Administration (FHWA) Highway Performance Monitoring System (HPMS), and specifically the pavement cracking distresses defined in the 2014 HPMS Field Guide (1).
- American Association of Highway Transportation Officials (AASHTO) Mechanistic-Empirical Pavement Design Guide (MEPDG), and specifically the MEPDG cracking distresses (2).
- Moving Ahead for Progress in the 21st Century Act (MAP-21) legislation (3), and specifically the draft pavement Notice of Proposed Rulemaking (NPRM) (4).

Successful translation of the data will enable use of LTPP data for national, State and/or local initiatives including:

- Validation of the pavement condition indicators and performance measures in the draft pavement rulemaking of the MAP-21 legislation.
- Validation and/or routine usage of national pavement analysis tools, including the Highway Economic Requirements Systems (HERS) (5) models and the Pavement Health Track (PHT) analysis tool (6).
- Development and/or validation of other national, State and/or local performance measures and/or indices.

For greater clarity of the information and/or instructions provided in this directive, the pertinent distresses are presented as defined in the LTPP Distress Identification Manual (DIM) along with their associated numbering in bold and parenthesis.

Other required pavement condition data – ride quality, rutting and faulting – will be directly extracted from the LTPP Information Management System (IMS) and translated, as needed and as appropriate by the TSSC. Accordingly, these data are not addressed in this directive.

ASPHALT CONCRETE (AC) PAVEMENTS: CRACKING PERCENTAGE

The translation information and/or instructions provided in this section apply to pavement sections with an AC surface and hence with data stored in the MON_DIS_AC_REV table that have associated distress maps. The instructions are the same for the AASHTO MEPDG and 2014 HPMS Field Guide so they are only provided once. No translations of the Draft MAP-21 NPRM are needed.

AASHTO MEPDG and 2014 HPMS Field Guide

The specific instructions for translating AC cracking percentage by the LTPP RSCs are as follows:

1. Review original maps or maps from the LTPP Ancillary Information Management System (AIMS) to identify length, in meters, of each wheelpath with cracking along the test section, including:

    + Longitudinal wheelpath cracking (**4a**)
    + Alligator cracking (**1**)

    All severity levels as well as sealed and unsealed cracks are to be included.

    No other types of cracking (including block cracking) will be considered as these will accounted for in the automated process.

2. Enter length of cracking for both wheelpaths into the spreadsheet (more on this later).

AC PAVEMENTS: CRACKING LENGTH

The translation information and/or instructions provided in this section apply to pavement sections with an AC surface and hence with data stored in the MON_DIS_AC_REV table that have associated distress maps. The instructions are the same for both the 2014 HPMS Field Guide and the AASHTO MEPDG, so they are only provided once. They do not apply to the other two applications.

AASHTO MEPDG and 2014 HPMS Field Guide

The translation of LTPP cracking distress data for AC pavements will be handled by the LTPP RSCs and the instructions are as follows:

1. Review original maps or maps from the LTPP AIMS to identify transverse cracks (6) less than 1.83 meters (six feet) in length along the test section and add the length of these transverse cracks, in meters.

   All severity levels as well as sealed and unsealed cracks are to be included.

   No other types of cracking (including block cracking) will be considered as these will accounted for in the automated process.

2. Enter total length of transverse cracks less than 1.83 meters (6 feet) into the spreadsheet.

Rationale: Since this is a partial instruction, the full instruction is given so that users can understand what is being done.

The 2014 HPMS Field Guide has a requirement that "A crack should be at least six feet long to be counted." Subsequent to this, the amount of transverse cracking will be calculated by subtracting the amount of cracking less than six feet from the total amount of transverse cracking on the section. This will yield a 2014 HPMS Field Guide compliant crack length.

An example is shown below (the yellow shaded portion is the data generated by this procedure).

REGION	STATE_CODE	SHRP_ID	SURVEY_DATE	TRANS_CRACK_LENGTH	TRANSVERSE_CRACKS_LESS_THAN_1.83_METERS	2014_HPMS_COMPLIANT_CRACKING
4	2	1001	5/31/1990	23.2	6	17.2
4	2	1001	8/21/1991	21.1	21.1	0
4	2	1001	8/26/1993	23.8	20	3.8
4	2	1001	6/15/1995	23.5	5	18.5
4	2	1001	8/22/1997	23.6	6.4	17.2
4	2	1001	8/26/1998	24.6	4.6	20
4	2	1001	6/24/1999	24	24	0
4	2	1001	7/14/2001	25.1	23	2.1
4	2	1001	6/16/2003	25.1	22	3.1
4	2	1001	5/5/2005	25.3	22	3.3

JOINTED PCC PAVEMENTS (JPCC): CRACKING PERCENTAGE

The translation information and/or instructions provided in this section apply to sections with a surface of jointed PCC and hence with data stored in the MON_DIS_JPCC_REV that have associated distress maps. Separate instructions are provided for the AASHTO MEPDG as well as for the other two applications (2014 HPMS Field Guide and draft MAP-21 NPRM), which are the same.

The translation of LTPP cracking distress data for jointed PCC pavement will be handled by the LTPP TSSC for those data contained in LTPP Standard Data Release (SDR) 29. The LTPP RSCs will be responsible for those data not in LTPP SDR 29.

AASHTO MEPDG

The specific instructions for translating jointed PCC cracking percentage by the LTPP RSCs are as follows:

1. Review maps from the LTPP AIMS to manually count the total number of slabs with transverse cracking using the criteria below:

    + A slab should be considered cracked if it contains a transverse crack (**4**), which extends at least 0.6 m from a longitudinal slab edge. The cracks must extend from a slab edge. Cracks extending less than 0.6 m from a slab edge should be excluded.
    + Sealed and unsealed cracks are to be included.
    + All severity levels of transverse cracks shall be included.
    + Any other type of cracking should be excluded.
    + If there are multiple transverse cracks within a slab, that slab is counted as a cracked slab only once.
    + Partial slabs should be considered as a full slab if length of partial slab is at least half as much of the length of a regular section slab. If partial slab length is less than half the length of a regular section slab, the partial slab should not be considered as a slab for these calculations.

2. Review maps from the LTPP AIMS to manually count the total number of slabs in test section.

3. Enter total number of cracked slabs from Step 1 and total number of slabs in section from Step 2 into the spreadsheet.

2014 HPMS Field Guide and Draft MAP-21 NPRM

The specific instructions for translating jointed PCC cracking percentage by the LTPP RSCs are as follows:

1. Review maps from the LTPP AIMS to manually count the total number of cracked slabs in the section using the criteria below:

    + A slab should be considered cracked if it contains a longitudinal crack (**3**) which extends at least 0.6 m from a slab edge. The cracks must extend from a slab edge. Cracks extending less than 0.6 m from a slab edge should be excluded.
    + A slab should also be considered cracked if it contains a transverse crack (4), which extends at least 0.6 m from a slab edge. The cracks must extend from a slab edge. Cracks extending less than 0.6 m from a slab edge should be excluded.
    + Sealed and unsealed cracks are to be included.
    + All severity levels of longitudinal and transverse cracks shall be included.
    + Presence of corner breaks (**1**), D-cracking (**2**), and map cracking (**9**) should be excluded.

- If there are multiple cracks within a slab, that slab is counted as a cracked slab only once.
- Partial slabs should be considered as a full slab if length of partial slab is at least half as much of the length of a regular section slab. If partial slab length is less than half the length of a regular section slab, the partial slab should not be considered as a slab for these calculations.

2. Review maps from the LTPP AIMS to manually count the total number of slabs, including partial slabs as defined above, in test section.

3. Enter total number of cracked slabs from Step 1 and total number of slabs in section from Step 2 into the spreadsheet.

CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS (CRCP): CRACKING PERCENTAGE

The translation information and/or instructions provided in this section apply to sections with a surface of CRCP and hence with data stored in the MON_DIS_CRCP_REV that have associated distress maps. Separate instructions are provided for the AASHTO MEPDG as well as for the other two applications (2014 HPMS Field Guide and draft MAP-21 NPRM), which are the same.

The translation of LTPP cracking distress data for CRCP will be handled by the LTPP TSSC for those data contained in LTPP Standard Data Release (SDR) 29. The LTPP RSCs will be responsible for those data not in LTPP SDR 29.

AASHTO MEPDG

The specific instructions for translating CRCP cracking percentage by the LTPP RSCs for data not included in LTPP SDR 29 are as follows:

1. Review original maps from the LTPP AIMS to manually count total number of punchouts (**12**) across medium and high severity levels. Low severity punchouts are not included.

2. Enter total number of punchouts (**12**) from Step 1 into the spreadsheet.

2014 HPMS Field Guide and Draft MAP-21 NPRM

The specific instructions for translating CRCP cracking percentage by the LTPP RSCs for data not included in LTPP SDR 29 are as follows:

1. Review original maps from the LTPP AIMS to estimate the total area of punchouts (**12**) across all severity levels, in square meters.

2. Enter total area of punchouts (**12**) from Step 1 into the spreadsheet.

PRIORITIES

Appendix A contains the test section priority for translation. Once a section is started, it should be finished for all construction numbers and all subsequent experiments.

QA PROCESS

A spreadsheet is provided as an electronic attachment to this directive. On a monthly basis, this spreadsheet should be delivered electronically (via email) to the TSSC for QA purposes.

QA reviews of the data will be completed in two weeks. The spreadsheet will be cumulative and include all translations to date. The spreadsheet should be named:

Western Region: WR_MM_DD_YYYY,
Southern Region: SR_MM_DD_YYYY,
North Atlantic Region: NA_MM_DD_YYYY, and
North Central Region: NC_MM_DD_YYYY.

The date of the submittal shall be used for the MM_DD_YYYY part of the file naming convention. In the submittal, the RSCs should indicate the "to" and "from" dates to be QA'd.

It is important that the distress maps for the translated surveys be scanned and present in AIMS for the QA to be completed.

The TSSC will perform QA on a sampling basis as follows:

1. For each lot (defined as data delivered in one shipment), data for 1 in 20 test sections are randomly selected for review. If no errors are found, entire lot is accepted for entry into the LTPP database.
2. A test section is considered to have an error when:
    a. AC Cracking Percentage: length differs by +/- 10%
    b. AC Cracking Length: length differs by +/- 10%
    c. JPCC Cracking Percentage: any deviation in number of cracked slabs or total slab count.
    d. CRCP (MEPDG): any deviation in number of punchouts.
    e. CRCP (2014 HPMS Field Guide and Draft MAP-21 NPRM): deviation in estimated area of punchouts greater than +/- 10%.
3. If data errors are found for only one test section, data for test section is rejected, but remainder of lot is accepted.
4. If data errors are encountered in 2 or more of test sections reviewed, an additional four test sections in twenty are reviewed (making a total of 5 in 20 for lot).
5. If no additional errors are found, test sections found to have errors are rejected, but remainder of lot is accepted.
6. If additional errors are found, entire lot is rejected. No further processing of test sections in rejected lot takes place until after resolution of problems found to the

satisfaction of the FHWA. Upon satisfactory resolution, revised lot is resubmitted for QA review. Failure of one lot does not alter review process for remaining lots.

Entry of the data into the IMS will be the responsibility of the TSSC. The TSSC will also be responsible for maintaining the spreadsheet in AIMS.

SCHEDULE

The translation of cracking distress data collected is to be completed by February 1, 2016 for all data that has been collected through December 31, 2015. Difficulties meeting the schedule will be discussed with the LTPP RSC Contracting Officers Representative (COR), and as appropriate, an alternate completion date may be established.

Data translation will continue for new surveys until the spring 2016 Distress Accreditation Workshop after which time the RSCs will collect the data as part of the distress surveys.

REFERENCES

1. *Highway Performance Monitoring System Field Manual*, Office of Highway Policy Information, Federal Highway Administration, Washington, D.C., March 2014

2. AASHTOWare Pavement Software, version 2.0.

3. Moving Ahead for Progress in the 21st Century (MAP-21), P.L. 112-141, July 6, 2012.

4. Notice of Proposed Rulemaking, Federal Register, Volume 80, No. 2 Part III, January 5, 2015. 23 CFR Part 490. Docket No. FHWA-2013-0053.

5. Highway Economic Requirements System – State Version Technical Report. Report No, FHWA-HIF-08-017. Federal Highway Administration, Washington, D.C., August 2005.

6. O'Toole, K., M. Alam, and L. Titus-Glover. Enhancement of the Pavement Health Track (PHT) Analysis Tool, Final Report. Office of Asset Management, Federal Highway Administration, Washington, D.C., September 2013.

Questions or clarifications relating to this directive should be addressed to the FHWA LTPP member responsible for pavement distress operations with copies to the LTPP FHWA Team Leader and the LTPP TSSC Program Manager and Principal Investigator.

Prepared by: TSSC

Approved by:

Aramis López, Jr.
LTPP Team Leader

Appendix A

Distress Translation Priorities

Priorities for Translations

The priorities are as follow:

1. QES BAA – all sections in the following States:
   a. Iowa
   b. Louisiana
   c. Michigan
   d. Oklahoma
   e. Oregon
   f. Pennsylvania
   g. Virginia
   h. West Virginia
   i. British Columbia

2. SPS WIM sites – logic is that these are the best traffic sites and most important for MEPDG calibration and not included in above list (AC only):
   a. 04 01**
   b. 10 01**
   c. 12 01**
   d. 12 05**
   e. 17 06**
   f. 18 06**
   g. 23 05**
   h. 24 05**
   i. 27 05**
   j. 35 01**
   k. 35 05**
   l. 39 01**
   m. 47 06**
   n. 48 01**
   o. 55 01**

3. Test sites in the following order of priority (again, going in order of MEPDG calibration sites):
   a. SPS-1
   b. SPS-8 (AC)
   c. SPS-9
   d. GPS-1
   e. GPS-2
   f. SPS-5
   g. SPS-6
   h. GPS-6
   i. GPS-7
   j. The rest of the sites.